

1. Determine whether each of the following changes is physical or chemical. What kind of property (chemical or physical) is being demonstrated in each case? (2 points)

- (a) the evaporation of rubbing alcohol ()
 (b) the bleaching of hair with hydrogen peroxide ()

2. Classify each of the following as a pure substance or a mixture. If it is a pure substance, classify it as an element or a compound. If it is a mixture, classify it as homogeneous or heterogeneous. (4 points)

- (a) sweat (,)
 (b) carbon dioxide (,)
 (c) aluminium (,)
 (d) vegetable soup (,)

3. Perform the following mathematical operations, and express each result to the correct number of the significant figures. (3 points)

a. $4.562 \times 3.99870 \div (452.6755 - 452.33) =$

b. $[(28.7 \times 10^5) \div 48.533] + 144.99 =$

c. $[(1.36 \times 10^5)(0.000322)/0.082] (129.2) =$

4. Determine the number of protons and electrons in each of the following ions. (2 points)

- a. Ni^{2+} ()
 b. S^{2-} ()
 c. Br^- ()
 d. Cr^{3+} ()

5. Give the ionic name of each of the following compounds. (3 points)

- (a) BrO_4^- ()
 (b) IO^- ()
 (c) ClO_2^- ()

6. Write the formula for each of the following compounds. (3 points)

(a) Phosphine:

(b) Silane:

(c) Diborane:

7. Predict whether each of the following compounds is soluble or insoluble. (4 points)

- (a) PbCl_2 () (b) CuCl_2 ()
 (c) $\text{Ca}(\text{NO}_3)_2$ () (d) BaSO_4 ()

8. A 7.83-g sample of HCN is found to contain 0.290 g of H and 4.06 g of N. Find the mass of carbon in a sample of HCN with a mass of 3.37 g. (5 points)

9. The ratio of oxygen to carbon by mass in carbon monoxide is 1.33:1.00. Find the formula of an oxide of carbon in which the ratio by mass of oxygen to carbon is 2.00:1.00. (5 points)

10. A pure copper sphere has a radius 0.935 in. How many copper atoms does it contain? [The volume of sphere is $(4/3) \times \pi r^3$ and the density of copper is 8.96 g/cm³.] (5 points)

11. Combustion analysis of a 13.42 g sample of equilin (which contains only carbon, hydrogen, and oxygen) produced 39.61 g CO₂ and 9.01 g H₂O. The molar mass of equilin is 268.34 g/mol. Find the molecular formula for equilin. (5 points)

12. The chloride of an unknown metal is believed to have the formula MCl_3 . A 2.395 g sample of the compound is found to contain 3.606×10^{-2} mol Cl. Find the atomic mass of M. (5 points)

13. A mixture of 50.0 g of S and 1.00×10^2 g of Cl_2 reacts completely to form S_2Cl_2 and SCl_2 . Find the mass of S_2Cl_2 formed. (5 points)

14. Titanium metal can be obtained from its oxide according to the following balanced equation: (5 points)



When 28.6 kg of C is allowed to react with 88.2 kg of TiO_2 , 42.8 kg of Ti is produced. Find the limiting reactant, theoretical yield (in kg), and percent yield.

15. The density of a 20.0 % by mass ethylene glycol ($C_2H_6O_2$) solution in water is 1.03 g/mL. Find the molarity of the solution. (6 points)

16. Treatment of gold metal with BrF_3 and KF produces Br_2 and $KAuF_4$, a salt of gold. Identify the oxidizing agent and the reducing agent in this reaction. Find the mass of the gold salt that forms when a 73.5 g mixture of equal masses of all three reactants is prepared. (10 points)

17. Upon combustion, a 0.8233 g sample of a compound containing only carbon, hydrogen, and oxygen produced 2.445 g CO_2 , and 0.6003 g H_2O . Find the empirical formula of the compound. (10 points)

18. A standard for determining the concentrations of acid solutions is sodium carbonate, Na_2CO_3 . In the acid-base titration of an 0.2610 g sample of pure Na_2CO_3 with a solution of HCl, a total of 37.32 mL were required to reach the stoichiometric point. What is the molar concentration of HCl in the solution? (10 points)

***** Molar mass *****

H = 1.01, He = 4.003, C = 12.01, N = 14.01, O = 16.00

F = 19.00, Na = 23.0, Si = 28.09, P = 30.97, S = 32.07

Cl = 35.45, Ca = 40.08, Au = 197.0, Ag = 107.9, K = 39.00

TiO_2 = 79.87 g/mol, CO_2 = 44.01 g, H_2O = 18.01 g,

(N_A = 6.022×10^{23} atoms/mol)